PATENT ABSTRACTS OF JAPAN

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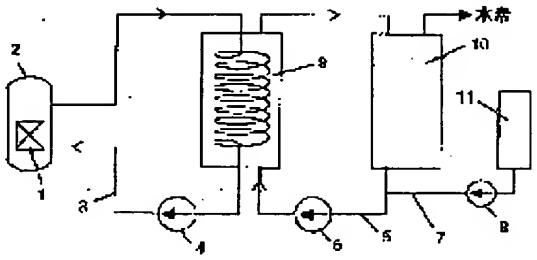
(72)Inventor : OKA YOSHIAKI

(54) METHOD FOR MANUFACTURING HYDROGEN WITH ATOMIC REACTOR

(57)Abstract:
PROBLEM TO BE SOLVED: To provide a method for manufacturing hydrogen through the use of heat from an atomic reactor.
SOLUTION: A reactor core 1 of the atomic reactor evolves heat by a nuclear fission chain reaction in a pressure vessel 2 of the atomic reactor. A cooling system 3 of the atomic reactor is connected to the pressure vessel 2 of the atomic reactor to supply a cooling medium with a pump 4 in the cooling system of the atomic reactor. The cooling medium, which is heated in the reactor core 1 of the atomic reactor to a high temperature, is introduced into a heat exchanger 9 to transfer the heat to a supercritical pressure hydrogen manufacturing system 5. While the supercritical pressure hydrogen manufacturing system 5 is kept under a supercritical pressure, a hydrocarbon is mixed with supercritical pressure water in the system and is circulated by a pump 6 in the supercritical pressure hydrogen manufacturing system. Hydrogen generated by a hydrolysis of the hydrocarbon in the supercritical pressure water is collected with a hydrogen extraction apparatus 10. The hydrocarbon is supplied through a hydrocarbon injection system 7 from a hydrocarbon storage tank 11 to the supercritical hydrogen manufacturing system 5 by driving force of a pump 8 in the hydrocarbon injection system.



LEGAL STATUS

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[Patent number]

[Date of registration]

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* NOTICES *

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CLAIMS

[Claim(s)]
[Claim 1] How to heat supercritical-pressure water using the heat generated from a reactor, to mix a hydrocarbon in this, and to manufacture hydrogen by the decomposition reaction.
[Claim 2] The hydrogen manufacture approach characterized by using a supercritical-pressure light water cooling furnace as a reactor in the hydrogen manufacture approach according to claim 1.
[Claim 3] The hydrogen manufacture approach characterized by mixing a direct hydrocarbon in the supercritical-pressure water which is flowing the inside of a reactor core in the hydrogen manufacture approach according to claim 2 in order to cool a supercritical-pressure light water reactor.
[Claim 4] The hydrogen manufacture approach characterized by using a predetermined rate for a generation of electrical energy among the heat generated at a reactor, and using the remaining heat for hydrogen manufacture in the hydrogen manufacture approach given in claims 1, 2, and 3.

[Translation done.]

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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] This invention relates to the hydrogen manufacture approach at a reactor.
[0002]
[Description of the Prior Art] Since supercritical-pressure water cuts a chemical bond, it can be used for harmful organic waste treatment, such as dioxin. Although its attention was not paid by the decomposition product until now, a hydrocarbon is disassembled using supercritical-pressure water and hydrogen can be manufactured. (the Yoshio Yoshizawa "application to efficient energy conversion technique of supercritical pressure condition" Japan Society for the Promotion of Science future exploitation research promotion enterprise "method [of generation and conversion of innovative future mold energy], ingredient, and systematization" research endeavor research result report in the Heisei 12 fiscal year, June, Heisei 13, page 88-98) hydrogen be a clean fuel which discharge neither a carbon dioxide nor harmful matter, and attract an attention as future automotive fuel which replace a gasoline and gas oil.
[0003] However, since there is a limitation in a fossil fuel as a heat source required for hydrogen manufacture at the amount of resources when using combustion of fossil fuels, such as coal and petroleum, hydrogen cannot be supplied over human beings' future at a long period of time. Furthermore, there are problems, such as global warming by discharge of carbon dioxide gas and air pollution by emission of harmful matter. Now, the generation source of the air pollution by the automobile moves from the time of automobile transit at the time of hydrogen manufacture.
[0004] A reactor is an energy source which hardly generates global warming gases and does not produce air pollution, either. There is an operation track record of many nuclear power plants in the world, it is safe and it is proved until now that it is low cost. Moreover, if a nuclear fuel cycle is established, energy can be supplied adequately over human beings' future at a long period of time.
[0005] Especially, a supercritical-pressure light water cooling furnace is a new reactor system by which researches and developments are performed briskly recently. (****** "concept of supercritical-pressure light water reactor" atomic energy industry, the 38th volume November issue, page 71-77 (1992)) The description is having adopted the flowing-through direct cycle which goes to a turbine, after the whole quantity of the cooling water by which the pressure up was carried out to using supercritical-pressure light water for a coolant with the feed pump cools a reactor. Therefore, the large simplification of a system is expectable, and it is observed noting that it excels in economical efficiency.
[0006] It is a global-warming-prevention overlay important point for about 1/3 of primary energy consumption in the world to be used for the transportation purpose, and to use nuclear energy for manufacture of the hydrogen as an energy carrier.
[0007]
[Problem(s) to be Solved by the Invention] A heat source is required to make a hydrocarbon mix in supercritical-pressure water, and manufacture hydrogen. However, in combustion of a fossil fuel, it cannot use for a long period of time as a heat source over human beings' future.

Moreover, problems, such as air pollution and global warming, are also produced.
[0008] The purpose of this invention is offering the approach of moreover manufacturing hydrogen economically over human beings' future at a long period of time.
[0009]
[Means for Solving the Problem] In order to solve the above-mentioned technical problem, in this invention, the heat generated at a reactor is used as a heat source for hydrogen manufacture. A reactor does not cause air pollution and has the outstanding property in which global warming gases are hardly generated, either. Furthermore, if a nuclear fuel cycle is established, it can use for a long period of time over human beings' future.
[0010]
[Embodiment of the Invention] The 1st operation gestalt of the hydrogen manufacture approach at the reactor of this invention is shown using drawing 1 . The reactor reactor core 1 generates heat by the fission chain reaction in a reactor pressure vessel 2. A reactor coolant system 3 is connected to a reactor pressure vessel 2, and a coolant is supplied with the reactor coolant system pump 4. The coolant which was heated by the reactor reactor core 1 and became an elevated temperature is led to a heat exchanger 9, and heat is made to be told to the supercritical-pressure hydrogen manufacture system 5. The supercritical-pressure hydrogen manufacture system 5 is maintained at a supercritical pressure, mixes a hydrocarbon in the supercritical-pressure water in a system, and is made to circulate through it with the supercritical-pressure hydrogen manufacture system pump 6. Hydrogen extraction apparatus 10 recovers the hydrogen generated by disassembly of a hydrocarbon in supercritical-pressure underwater. A hydrocarbon passes along the hydrocarbon impregnation system 7 with the driving force of the hydrocarbon impregnation system pump 8 from the hydrocarbon storage tank 11, and is supplied to the supercritical-pressure hydrogen manufacture system 5.
[0011] Here, as a coolant of a reactor, light water, heavy water, liquid sodium, gaseous helium, carbon dioxide gas, etc. can be considered.
[0012] As a hydrocarbon mixed in the supercritical-pressure water of a supercritical-pressure hydrogen manufacture system, natural gas, petroleum, coal, methane, ethane, a methanol, ethanol, etc. can be considered.
[0013] Next, the 2nd operation gestalt of the hydrogen manufacture approach at the reactor of this invention is shown using drawing 2 . The description here is using a supercritical-pressure light water cooling furnace as a reactor in the 1st operation gestalt. That is, the supercritical-pressure light water cooling furnace reactor core 12 is used for drawing 2 like as a reactor reactor core 1 in drawing 1 , the supercritical-pressure light water cooling furnace pressure force container 13 is used for drawing 2 like as a reactor pressure vessel 2 in drawing 1 , the supercritical-pressure light water cooling furnace cooling system 14 is used for drawing 2 like as a reactor coolant system 3 in drawing 1 , and the supercritical-pressure light water cooling furnace cooling system pump 15 is used for drawing 2 like as a reactor coolant system pump 4 in drawing 1 .
[0014] At a supercritical-pressure light water cooling furnace, reactor core outlet temperature can be made into an elevated temperature, and it is more advantageous to hydrogen manufacture than the present light water reactor which makes subcritical ****** a coolant. Moreover, since the reactor system is simple, a hydrogen manufacturing cost can be made cheap.
[0015] Next, the 3rd operation gestalt of the hydrogen manufacture approach at the reactor of this invention is shown using drawing 3 . The description here doubles the supercritical-pressure light water cooling furnace cooling system and supercritical-pressure hydrogen manufacture system in the 2nd operation gestalt, and makes them a single network. That is, a direct coolant is supplied to the supercritical-pressure light water cooling furnace reactor core 12 from the supercritical-pressure hydrogen manufacture system 14. In this case, the hydrocarbon mixed in the supercritical-pressure hydrogen manufacture system will also pass a reactor core. The coolant which came out of the supercritical-pressure light water cooling furnace reactor core 12 is led to hydrogen extraction apparatus 10, and collects hydrogen here.
[0016] This is a system by which both of the pressures, a supercritical-pressure hydrogen

manufacture system and a supercritical-pressure light water cooling furnace cooling system, become possible from it being a supercritical pressure to light water. Since the number of networks decreases, it can be expected that economical efficiency improves further.
[0017] Next, the 4th operation gestalt of the hydrogen manufacture approach at the reactor of this invention is shown using drawing 4 . Most current commercial reactors are large-sized reactors for a generation of electrical energy, and it generated the steam of elevated-temperature high pressure using the heat of a reactor, and, thereby, has turned and generated the turbine. Then, a predetermined rate is used for a generation of electrical energy among the heat generated at a reactor, and the remaining heat is used for hydrogen manufacture.
[0018] In drawing 4 , it has the hydrogen manufacture approach at the reactor shown in drawing 1 , and a network for a generation of electrical energy. That is, a coolant is supplied to the reactor reactor core 1 from the reactor coolant system 3 for heating the supercritical-pressure hydrogen manufacture system 5, and both of the cooling system reactor inlet-port piping 16 for a generation of electrical energy. A part of coolant heated by the reactor reactor core 1 uses the remaining coolants as a heat source of hydrogen manufacture toward the network for a generation of electrical energy from the cooling system reactor outlet piping 17 for a generation of electrical energy.
[0019] In order to use a predetermined rate for a generation of electrical energy among the heat generated at a reactor and to use the remaining heat for hydrogen manufacture, reactor coolant system pump-control equipment 18 is installed in the reactor coolant system pump 4, and a flow rate is controlled. The maximum stream flow, then the amount of hydrogen manufactures serve as max, and zero, then the amount of hydrogen manufactures serve as zero in a flow rate. Supposing the output of a reactor is fixed, the amount of generations of electrical energy will decrease conversely as the amount of hydrogen manufactures is made to increase.
[0020] Use a predetermined rate for a generation of electrical energy among the heat generated at a reactor, and install the approach and branch pipe which install a valve in a reactor coolant system and otherwise control the opening as an approach of using the remaining heat for hydrogen manufacture, a flow rate is made to bypass, and how to control the by-pass rate etc. can be considered.
[0021] With this operation gestalt, both the functions of a generation of electrical energy and hydrogen manufacture are attained at one reactor. To the existing power reactor, it is realizable by installing a hydrogen manufacturing system additionally. There is an advantage that each volume can be changed, corresponding to change of the need of the electrical and electric equipment and hydrogen.
[0022] In drawing 4 , although a generation-of-electrical-energy system is added to the hydrogen manufacture approach of the operation gestalt 1, a generation-of-electrical-energy system may be similarly added to the operation gestalt 2 and the operation gestalt 3.
[0023]
[Effect of the Invention] this invention -- human beings' future -- crossing -- a long period of time -- and the approach of manufacturing hydrogen economically can be offered. If the current automobile using a fossil fuel is changed to the automobile which uses hydrogen as a fuel, the need of hydrogen will grow by leaps and bounds. This invention can fulfill the need. In combustion of hydrogen, harmful matter is not generated but water only produces it. Moreover, if hydrogen is manufactured using a reactor like this invention, the carbon dioxide which brings about global warming at the time of hydrogen manufacture will hardly be generated, and will not produce the air pollution by harmful matter, either. Therefore, it is advantageous also to maintenance of earth environment.

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TECHNICAL FIELD

[Field of the Invention] This invention relates to the hydrogen manufacture approach at a reactor.

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PRIOR ART

[Description of the Prior Art] Since supercritical-pressure water cuts a chemical bond, it can be used for harmful organic waste treatment, such as dioxin. Although its attention was not paid by the decomposition product until now, a hydrocarbon is disassembled using supercritical-pressure water and hydrogen can be manufactured. (the Yoshio Yoshizawa "application to efficient energy conversion technique of supercritical pressure condition" Japan Society for the Promotion of Science future exploitation research promotion enterprise "method [of generation and conversion of innovative future mold energy], ingredient, and systematization" research endeavor research result report in the Heisei 12 fiscal year, June, Heisei 13, page 88-98) hydrogen be a clean fuel which discharge neither a carbon dioxide nor harmful matter, and attract an attention as future automotive fuel which replace a gasoline and gas oil.
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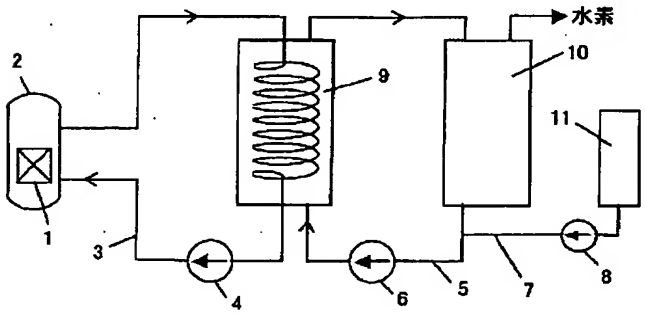
DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] Drawing showing the hydrogen manufacture approach of having used the heat of a reactor.
[Drawing 2] Drawing showing the hydrogen manufacture approach of having used the heat of a supercritical-pressure light water cooling furnace.
[Drawing 3] Drawing showing how to manufacture direct hydrogen by the cooling system of a supercritical-pressure light water cooling furnace.
[Drawing 4] Drawing showing the hydrogen manufacture approach of having used a part of heat of a reactor.
[Description of Notations]
1 Reactor Reactor Core
2 Reactor Pressure Vessel
3 Reactor Coolant System
4 Reactor Coolant System Pump
5 Supercritical-Pressure Hydrogen Manufacture System
6 Supercritical-Pressure Hydrogen Manufacture System Pump
7 Hydrocarbon Impregnation System
8 Hydrocarbon Impregnation System Pump
9 Heat Exchanger
10 Hydrogen Extraction Apparatus
11 Hydrocarbon Storage Tank
12 Supercritical-Pressure Light Water Cooling Furnace Reactor Core
13 Supercritical-Pressure Light Water Cooling Furnace Pressure Force Container
14 Supercritical-Pressure Light Water Cooling Furnace Cooling System
15 Supercritical-Pressure Light Water Cooling Furnace Cooling System Pump
16 Cooling System Reactor Inlet-Port Piping for Generation of Electrical Energy
17 Cooling System Reactor Outlet Piping for Generation of Electrical Energy
18 Reactor Coolant System Pump-Control Equipment

[Translation done.]

Drawing selection Representative drawing



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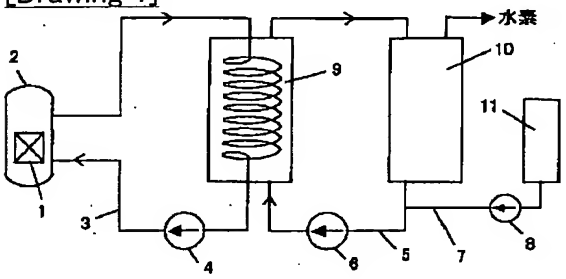
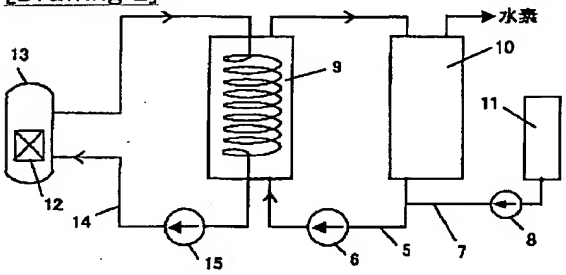
DRAWINGS

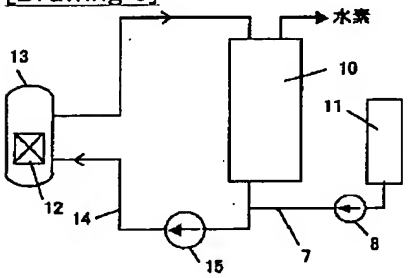
[Drawing 1]



[Drawing 2]



[Drawing 3]



[Drawing 4]